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A CATALOGUE OF THE EXPERIMENTS MADE BY Mr. *KING*, In his Courſe of NATURAL PHILOSOPHY.

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This COURSE conſiſts of FOUR PARTS.

IN the firſt are laid down the Principles of Mechanics, the Laws of Motion, and the ſeveral Operations of Engines ſhewn, together with Rules to eſtimate the Quantity of Friction in Engines.

IN the Second, the Motions of the Heavenly Bodies are explained by proper Machines, and the Laws of Centripetal and Centrifugal Forces ſhewn by a Curious Apparatus, which demonſtrates the Manner of their moving round the Sun; alſo the Motion and Figure of the Earth, and what is underſtood by Aſtronomical Areas, deſcribed in equal Times, together with the Diſcovery of the Velocity of Light.

IN the Third, the Nature of Fluids is explain'd, the Laws of Hydroſtatics demonſtrated, the Properties of the Air, and all the Phenomena that depend upon its Preſſure and Elaſticity, its Condenſation and Rarefaction; the Manner how it is vitiated, and how purified, ſhewn by great Variety of Experiments.

The Fourth Part treats of Opticks, conſidering Reflected Viſion, Refracted Viſion, the Diſſection of the Eye, the Conſtruction of Optical Machines, and Sir ISAAC NEWTON's Theory of Light and Colours.

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PART I.

LECTURE I.

OF Natural Philoſophy, or that Science which teaches how to account for the Phænomena of Bodies, and the Laws by which they act,

Of Matter.

That Matter is the ſame in all Bodies.

f the Diviſibility of Matter.

f the Attraction of Coheſion.

f the Proportion of its increaſing and decreaſing Force.

ow it acts between Lead Balls.

- Water and Glaſs.

- Quickſilver and Iron.

- Oil and Glaſs, *&c.*

e aſcent of Sap in Plants accounted for.

e ſoddering of Metals and glewing of Boards ccounted for.

y the Feathers of Birds are not wetted by Rain;

hen this attraction is prevented.

Space.

a Vacuum.

acuum proved.

he univerſal Law of Gravity.

Law illuſtrated and prov'd.

Proportion of its decreaſing and increaſing rce ſhewn.

LECTURE II.

OF Electrical Attraction.

This ſhewn between Amber and ſeveral Subſtances.

Between Glaſs and Leaf Gold.

- - - - Glaſs and Feathers.

Of electrical Repulſion.

Surpriſing Phænomena of electrical Attraction an Repulſion.

Of its increaſing and decreaſing Force.

Of the magnetic Attraction and Repulſion.

Of its increaſing and decreaſing Force.

Of artificial Magnets.

Some new Diſcoveries of magnetical Attractio and Repulſion.

LECTURE III.

OF Motion and Velocity.
Motion diſtinguiſh'd from Velocity.
Of the Centre of Gravity in Bodies.
Of the Centre of Magnitude.
Of the Centre of Motion.
Rules ſor finding them in all Bodies.
How to find the Centre of Gravity of a Syſtem of Bodies.
The *Chineſe* Dotchines.
That the Centre of Gravity will deſcend as low as it can.
That upon this Principle Bodies may appear to roll upwards.
That others will actually roll upwards.
Of the Compaſſes on board Ships and rolling Lamps.
That if the Centre of Gravity be ſupported, the Body will not fall.
This apply'd to the placing Statues and other Decorations upon Buildings.
Heavy Bodies, which of themſelves would fall from a Pedeſtal, hindred from falling, by adding another heavy Body to them.
Of the falling, ſliding, and rolling of heavy Bodies.
Why Towers and Buildings much inclin'd do not fall.

LECTURE IV.

OF a Weight and Power.
Of their acting Diſtance.
Of their Lines of Direction.
Of oblique Traction.
Of ſome ſurpriſing Feats of Strength perform'd upo
this Principle.
Of the Lever.
Of the Balance.
Of the falſe Balance.
Of the Pully ſingle and combin'd.
Of the Axle and Wheel.
Of the inclin'd Plane.
Of the Wedge.
Of the Screw.
That the Tools of Artificers are ſome of the abov
Inſtruments, tho' not called by thoſe Names.

LECTURE V.

OF compound Levers.

Of a Machine in which all the mechanic Powers are employ'd.

Of the Fuzee, and how it is apply'd in Watches and other Machines.

A Model of the Engine for driving Piles.

A Model of a curious Crane.

How Men or Horſes may carry or draw Burthens in proportion to their Strength.

Of the Advantages of large and ſmall Wheels in Coaches, Cars, &c.

LECTURE VI.

OF the impoſſibility of a Perpetual Motion.

Curious Experiments to ſhew how People are ſo often deceiv'd in the ſearch of it.

Of Friction in mechanical Machines.

- - - how much it is in Bodies drawn upon horizontal Plains and in circular Motions.

- - - how to be eſtimated in all mechanical Machines.

With the Explanation of the Theorem for finding the Sum of the Infinite Series, from which the Friction is deduced, being of great Uſe to all Mechanical Artificers.

LECTURE VII.

OF the Laws of Nature, commonly called Sir Iſaac Newton's Laws of Motion.

The firſt Law demonſtrated.

Of the reſiſtance of Mediums.

Of the Compoſition of Forces.

That if two equal Forces act upon a Body at the ſame time in contrary Directions, the Body will be at reſt.

That if thoſe Forces do not act in contrary Directions, the Body will move thro' the Diagonal of a Parallelogram, whoſe Sides are as thoſe Forces.

That if a Body be projected from another Body, whoſe Motion is uniform, the Line of its relative Aſcent and Deſcent will be the ſame, as if the Body from which it was projected had been at reſt.

From whence may be anſwered, a popular Objection againſt the Motion of the Earth.

Shooting Flying, accounted for.

LECTURE VIII.

THE ſecond Law of Motion demonſtrated.

Of accelerated, retarded, and uniform Motion.

Of the falling of Bodies in reſiſting Mediums, and in Vacuo.

Of abſolute and relative Gravity.

Of the Doctrine of Pendulums.

Of the expanding of Metals by heat, and contracting by Cold, ſhewn by the Pyrometer, a Curious Inſtrument which meaſures the Expanſion to the 24,000th Part of an Inch.

Of the Line of ſwifteſt Deſcent, and in what manner it is deſcrib'd.

Of the congreſs of Bodies.

Of the elaſticity of Bodies.

The third Law of Motion demonſtrated.

Flying and Swimming accounted for.

PART II.

LECTURE IX.

OF the Curves in which Projectiles move.

Curious Experiments to ſhew the Foundation of the Art of Gunnery.

Of the centrifugal and centripetal Force of ſolid and fluid Bodies in motion.

Monſ. *Des Cartes*'s Vortices exploded.

Of the Curves deſcrib'd by the heavenly Bodies and the Laws by which they are kept in their Orbits, demonſtrated.

That if the centrifugal exceeds the centripetal Force, the Body will recede from the centre of its Motion.

The Line in which it will recede ſhewn.

That if the centripetal exceeds the centrifugal Force, the Body will approach the centre of its Motion.

The Line in which it approaches ſhewn.

The Motion and Figure of the Earth demonſtrated.

LECTURE X.

A New Machine, ſhewing all the Phænomena that depend upon the motion of the Earth and Moon, round the Sun, *viz.*

The annual and diurnal Motion of the Earth and Paralleliſm of its Axis, by which the difference of Seaſons are produced.

The increaſe and decreaſe of Day and Night in different parts of the Globe.

The difference between the real and apparent Revolution of the Sun about its Axis.

The difference between the ſolar and ſyderial Day.

The Phaſes of the Moon, motion of the Nodes, and inclination of her Orbit.

The difference between the Moon's ſynodical and periodical Month.

The Cauſe of ſolar and lunar Eclipſes, and their Uſe.

The Moon's Motion round its Axis, and the Method of diſtinguiſhing between Hills and Dales in the Moon.

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LECTURE XI.

THE ſolar Syſtem ſhewn by the Machine, with the manner of meaſuring the Diſtances of the heavenly Bodies by the Doctrine of Paralaxes and Moon's Dichotomy.

The direct Motions, Stations, and Retrogradations of the Planets explained and accounted for.

The heliocentric and geocentric Places of the Planets ſhewn, for any given Time.

Of their Excentricity and Latitudes.

Of the Phaſes of Venus and Mercury, with their Tranſits over the Diſk of the Sun.

Of the Belts and Spot of Jupiter.

Of his Motion round his Axis.

Of his Satellites, and the Diſcovery of the velocity of Light by their Eclipſes.

Of Saturn's Ring, with its different Appearances in different parts of his Orbit.

Of the Satellites of Saturn and their Eclipſes.

PART III.

LECTURE XII.

OF Fluids in general, and of dividing them into real and imaginary Surfaces, and perpendicular Pillars.

That Fluids gravitate upon Fluids of the ſame kind.

That Fluids of different kinds gravitate upon each other.

That Fluids preſs in all Directions.

That a Fluid may ſupport a Solid ſpecifically heavier than the Fluid.

That a Fluid will hinder a Solid (lighter than the Fluid) from riſing.

Rules for finding the ſpecific Gravities of ſeveral ſorts of Wood.

That floating Bodies diſplace as much of the Fluid as is equal to their Weight.

The Conſtruction and Uſe of the Hydrometer or Water Poize.

A curious Inſtrument for finding the Strength of Spirituous Liquors.

LECTURE XIII.

THAT the Preſſure of Fluids is as their Heights and Baſes.

This Paradox prov'd by curious Experiments.

The Water Bellows.

A Chain of inflated Bladders apply'd to muſcular Motion from this Principle.

Of the Weight that Solids looſe when weigh'd in Fluids.

The hydroſtatical Balance for determining the ſpecific Gravities of Metals, Oars, *&c.*

Archimedes's Propoſition, ſhewing how he diſcovered the quantity of Gold and Silver in King *Hiero*'s Crown.

Of finding the Solidity of irregular Bodies.

LECTURE XIV.

OF the Air.

The Air-Pump diſſected, and its Valves and Piſtons ſhewn, and manner of working explain'd.

That the Air is a heavy Fluid.

A Bottle broke by the weight of the Air.

Its Weight upon any Surface ſhewn.

How it acts upon Fluids.

The Conſtruction of Barometers and their Uſe, with Obſervations for making them correct.

Of meaſuring heights of Mountains and depths of Mines by this Inſtrument.

That Air weighs in Air.

LECTURE XV.

THE Conſtruction and Working of Syphons, with the Uſe of the Antigugelor.

Of the Tantalus Cup, ſhewing the reaſon why ſome Ponds loſe all their Water when fill'd full.

The flowing of Springs accounted for and ſhewn by Machines.

LECTURE XVI.

OF the Expanſion of Water.

The Force of this Expanſion ſhewn.

The Aſcent of Vapours accounted for, and their reſolution into Rain.

A working Model for raiſing Water by Fire.

Of the Expanſion of Spirits.

Of the Expanſion of Quickſilver.

The Conſtruction and Uſe of the Thermometers ſhewn, which depend upon theſe Principles.

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LECTURE XVII.

OF the Expanſion of the Air.

Of the Force with which it depends.

Of the Air in Eggs, with a method of Preſerving them.

Of the Air in Apples.

Of the Air in Beer.

Of the Air in Water, and how it acts when the Water boils, or is frozen into Ice.

Of the ſpecific Gravity of Ice.

A portable Vacuum to ſhew how the Spring of the Air acts upon Fluids.

The riſing and falling of Glaſs Bubbles accounted for.

A Bottle broke under Water by the Spring of the Air.

The floating of drown'd Bodies accounted for.

How the Air expands by Heat.

Cupping explain'd.

The Conſtruction of the Air Thermometer.

LECTURE XVIII.

THE *Florentine* Experiment, to ſhew that Water is incompreſſible, with other curious Attempts to compreſs Water, which ſhew how it pervades the Pores of ſeveral Metals.

Of the condenſing of Air.

The condenſing Engine diſſected.

The Conſtruction of a Gauge for finding the quantity of condenſed Air.

A blown Bladder made flaccid by condenſed Air.

A Bottle broke by condenſed Air.

The Wind-Gun diſſected, and its Valves and Piſton ſhewn.

The Force of the Spring of condenſed Air apply'd to ſeveral uſeful Mechanical Purpoſes.

LECTURE XIX.

OF the Expence of Water from Reſervoirs at equal Holes.

That Water will riſe in Pipes to the ſame height from which it was convey'd.

How much it falls ſhort when it plays thro' Jets.

That projected Fluids move in the ſame Curves as projected Solids do.

Of Pipes of Conduct, and Method of making Jets.

Hiero's Fountain.

The Fountain by compreſs'd Air.

The Fountain by Attraction.

The Fountain at command.

An Hour-Glaſs Fountain.

LECTURE XX.

OF the abſorbing and generating of Air.
The Damps in Mines accounted for.
The Grotto *Del Cani* accounted for.
Curious Experiments, ſhewing the effect of vitiated Air upon the Life of Animals.
Of Reſpiration.
This ſhewn by an Inſtrument to explain the Motion of the Lungs and Diaphragma in Natural Reſpiration.
Another Curious Machine contriv'd, by Dr. *Hoadley*, which ſhews all the different Caſes of diſturb'd Reſpiration.
How much Air we deſtroy by breathing.
How much a burning Candle deſtroys.
How deſtroy'd by Sulphur.
Curious Experiments of ſounding Bodies.
That Sound can't be convey'd without Air.
The Exploſion of Gun-powder and Thunder accounted for.
Gun-Powder fir'd in Vacuo.

LECTURE XXI.

THE Diver's Bell with all the Improvements, by Dr. *Halley*.

The Method of letting out foul, and ſending down freſh Air.

Of the Cap of Maintenance for thoſe who go out of the Bell.

A Sea-Gauge for bringing up Soundings without a Line.

Of another for meaſuring the Depth of the Sea correctly without a Line, invented by the Rev. Dr. *Stephen Hales*, and tried by me in the *Baltic*, in 288 Foot Water.

Alſo an Account of ſome Curious Experiments then made upon Glaſs Bottles let down into the Sea.

LECTURE XXII.

THE ebbing and flowing of the Sea accounted for and explain'd by Machines.

The Diſcharge of Water from the *Mediterranean* accounted for.

That the Waves of the Sea agree with the Vibrations of a Pendulum.

The Circulation of the Blood ſhewn in the Bodies of Animals, by a peculiar Machine; in ſuch manner, that the Globules are not only diſtinguiſhed from the Serum, but the different Colour of the Blood in the Veins and Arteries, and the different Direction of their Motions, are ſhewn.

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PART IV.

LECTURE XXIII.

THE NEWTONIAN and *Carteſian* Definition of Light compar'd.

The *Newtonian* Definition demonſtrated.

That Light is a Body.

Of its Particles and their Velocity.

Of Viſion in general.

Of Objects and Images.

Why a Picture is a Repreſentation of an Object.

Of lucid Bodies.

Of opake Bodies.

Of Incidence and Reflexion.

Of the Plane of Inflexion.

Of plane concave and convex Mirrors.

Of Pictures optically deform'd.

Of the multiplying of Images.

Of the quantity of Light reflected from different Bodies.

Of the mixing of Images by irregular Surfaces.

LECTURE XXIV.

OF tranſparent Bodies.

Of the Cauſe of Opacity and Tranſparency.

How Light paſſes thro' tranſparent Bodies.

Of Incidence and Refraction.

Of the Cauſe of Refraction.

Of multiplying Glaſſes.

Of Lenſes of all ſorts, with Rules for finding their Foci.

How to know a Lenſe from a piece of plain Glaſs.

How to find it truly centred.

Of the Difference between the apparent and true Altitudes of the heavenly Bodies.

The *Greenwich* Phænomenon accounted for.

The Phænomena of a piece of Money in a Baſon of Water and under a Glaſs, ſhewn and accounted for.

LECTURE XXV.

THE Diſſection of the Eye.

Of the Muſcles of the Eye.

Of the Cornea.

Of the Sclerotica.

Of the Aqueous Humour.

Of the Iris and Pupil.

Of the Chryſtalline Humour.

Of the Arania.

Of the Ligumentum Ciliari.

Of the Vitreous Humour.

Of the Retina.

Of the Optic Nerve.

Of the Choroides.

Of the croſſing of the Optic Nerves.

Of the Difference between Looking and Seeing.

Of the Diſeaſes of the Eye, with the Method of Couching.

Of ſhort and long-ſighted Eyes, and their helps by Glaſſes.

How the Images are painted upon theRetina, ſhewn by an artificial and real Eye.

LECTURE XXVI.

OF refracting Teleſcopes.
Of reflecting Teleſcopes.
Of Microſcopes ſingle and double, and their Uſe.
Of the new improv'd Microſcope.
Of the Magic Lanthern.
Of the Solar Microſcope, by which 20 Perſons may ſee the Object at the ſame time, and magnified much more than in the Common Way.

LECTURE XXVII.

SIR ISAAC NEWTON's Theory of Light and Colours demonſtrated.

Of the Rain-Bow.

Of the Haloes round the Sun and Moon.

Of the Water Lenſe.

Of the Camera Obſcura.

LECTURE XXVIII.

Contains ſeveral curious miſcellaneous Experiments, with a Repetition of the principal Demonſtrations in the preceding Lectures, together with ſuch new Experiments as may have been found out during this Courſe.

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